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EXAMINER	
RICHER, AARON M	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/796,695	YOUNG, WAYNE D.	
	Examiner	Art Unit	
	Aaron M. Richer	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 February 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 5-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 and 5-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed February 28, 2007 have been fully considered but they are not persuasive.

2. As to claims 1, 12, and 20, applicant argues that the claims select between a first color and second color for output to a display, while Quintana discloses a printed pixel having on and off states. Applicant states that because the "off" pixels are not actually printed, the method differs from the claimed invention. Examiner notes, however, that a pixel that is turned off, or not output, still has a "final pixel color", that pixel color being equivalent to white. Quintana addresses this in paragraph 0025, disclosing that "it is said that the lower value that an output pixel can have is zero, and the upper value that an output pixel can have is 255". Here, the "final pixel color" is either 0 (representing white) or 255 (representing full cyan, magenta, yellow, or black). Note that in the above cited disclosure, *an output value of 0 is still considered an output pixel by Quintana.*

3. Applicant further argues that outputting a pixel on a display device is different from outputting a pixel on a printer. Examiner disagrees with this statement noting that one skilled in the art would consider printers to be a subset of display devices. Display device is not necessarily synonymous with monitor and it is common for a printer to be considered a display device. To show the state of the art, the following patent publications are cited (note that none of these are being cited as prior art):

U.S. Publication 2007/0040838 to Jeffrey (paragraph 0028 states that "In one embodiment, the display device 26 may be a printer")

U.S. Publication 2006/0132496 to Horton (paragraph 0002 states that "The color component values assigned to the different pixels by the texture mapper are then utilized to color the object's surface when the object is displayed by a display device, such as a display monitor or a printer, for example.")

The confusion here may lie in the fact that there are essentially two different stages of "output pixels" in the Quintana reference. The first stage is the color value (0 or 255) decided after accumulated error has been taken into account, such as in paragraph 0025 of Quintana. The second is the actual physical blot of ink on the paper, which is what Quintana is referring to when the reference describes choosing to output or not output a pixel. This is no different from a monitor, however: Even though a completely black pixel on a display may be considered to be "off", it still is regarded as an "output pixel" with RGB value of (0,0,0).

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-3, 10-15, 17, 18, and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Quintana (U.S. Publication 2004/0100646).

6. As to claim 1, Quintana discloses a method of dithering an image, the method comprising the acts of:

receiving a target color at a high color resolution for a current one of a plurality of pixels of the image, the target color being intermediate between a first color and a second color at a low color resolution (fig. 3, p. 2, section 0025; the example of a 186 color component value is given in a 0 or 255 binary system);

tracking an accumulated error across the plurality of pixels up to and including the current pixel (fig. 3; p. 2, section 0025; an "accumulated error" is a running total of differences between intensity values and actual output values; the current pixel is also included at fig. 3, element 312);

selecting one of the first color and the second color as a final pixel color, wherein the first color is selected in the event that the accumulated error is less than a threshold, wherein the second color is selected in the event that the accumulated error exceeds the threshold (fig. 3, elements 310, 106; an "on" pixel is output when the error exceeds a certain value, otherwise the pixel is not turned on).

providing an updated accumulated error to a next one of the plurality of pixels (fig. 3, element 114; after all color component values for a single pixel have been decided, the system moves on to the next pixel and repeats the process);

and outputting the selected final pixel color for display on a display device (fig. 3, element 106; p. 2, section 0025; a final pixel color value of 0 or 255 is selected for output on a printer, which reads on a display device; this final color value that appears

on a piece of printed paper corresponds to white if 0 and cyan, magenta, yellow, or black if 255).

While the disclosure of Quintana does not specifically disclose that the accumulated error is reduced below the threshold in the event that the second color is selected, simple calculations show that this is inherent to the invention. Quintana subtracts the value for output pixel from the accumulated error to calculate a new accumulated error in fig. 3, element 314. Assume the first color value is zero, and the second color is 255, as in the example of p. 2, section 0025. Now, looking at the embodiments disclosed in p. 3, section 0031, the maximum error value is 256. The corresponding threshold value (i.e. the value which all values must be LESS than) is 257.

In the absolute worst case scenario, the accumulated error after step 308 of fig. 3 would be:

(max. error value) + (max. possible current color component value) =

255 + 256 = 511

In step 106, an output pixel of value 255 would be output. Then in step 314, the accumulated value would be adjusted to:

(accumulated error) – (output value) = 511 – 255 = 256

Thus, the accumulated error would be 256, reduced below the threshold value of 257. If the second color is selected, 255 is always subtracted from the accumulated error meaning that the error will always be reduced below the threshold in the event that the second color is selected.

7. As to claim 2, Quintana discloses a method wherein the act of tracking the accumulated error includes the acts of:

determining a current error based on a difference between the first color and the target color (fig. 3, element 312; the "current error" is the absolute difference);

and adding the current error to the accumulated error (fig. 3, element 312; the error adjustment factor is a second variable which tracks error, and therefore this reads on an accumulated error as well).

8. As to claim 3, Quintana discloses a method further comprising the act of reducing the accumulated error by an amount corresponding to the threshold in the event that the second color is selected (see rejection to claim 1, the value subtracted and the threshold are substantially corresponding, only 1-2 values different).

9. As to claim 10, Quintana discloses a method wherein the threshold corresponds to a difference between respective high resolution representations of the first color and the second color (see rejection to claim 1; the threshold and difference between colors are substantially corresponding, only 1-2 values different).

10. As to claim 11, Quintana discloses a method wherein the target color is one of a plurality of independent color components for the pixel (fig. 3, elements 304, 306; the target color corresponds to one of a plurality of independent color components).

11. As to claim 12, Quintana discloses a device for dithering an image, the device comprising:

an accumulator module configured to track an accumulated error across a plurality of pixels of the image (fig. 3; p. 2, section 0025; an "accumulated error" is a

running total of differences between intensity values and actual output values; the current pixel is also included at fig. 3, element 312);

a conversion module configured to receive a high resolution color signal for a current pixel of the image and to generate a corresponding low resolution color signal (fig. 3, p. 2, section 0025; the example of a 186 color component value is given in a 0 or 255 binary system);

and an adjustment module configured to modify the low resolution color signal from a first color to a second color for the current pixel in the event that the accumulated error exceeds a threshold (fig. 3, elements 310, 106; an "on" pixel is output when the error exceeds a certain value, otherwise the pixel is not turned on; the "current" color is changed from a value that would just be rounded to an error-adjusted value reading on a change from "first color" to "second color");

and an output module configured to output the low resolution color signal for the current pixel for display on a display device (fig. 3, element 106; p. 2, section 0025; a final pixel color value of 0 or 255 is selected for output on a printer, which reads on a display device; this final color value that appears on a piece of printed paper corresponds to white if 0 and cyan, magenta, yellow, or black if 255), wherein after processing the current pixel, the accumulated error is provided to a next one of the plurality of pixels (fig. 3, element 114; after all color component values for a single pixel have been decided, the system moves on to the next pixel and repeats the process).

12. As to claim 13, Quintana discloses a device wherein the accumulator module includes:

a current error circuit configured to extract a current error from the high resolution color signal for the current pixel (fig. 3, element 312; the "current error" is the absolute difference);

and a first adder circuit configured to add the current error to the accumulated error and to provide an updated accumulated error to the adjustment module (fig. 3, element 312; the error adjustment factor is a second variable which tracks error, and therefore this reads on an accumulated error as well).

13. As to claim 14, Quintana discloses a device wherein the adjustment module includes:

a comparator circuit configured to compare the updated accumulated error to a threshold, thereby generating a dither control signal (fig. 3, element 310; an accumulated error is compared with a "maximum allowed error value");

and a second adder circuit configured to receive the low resolution color signal from the conversion module and to adjust the received low resolution color signal based on the dither control signal, thereby generating a final color signal (fig. 3, element 106; an "on" pixel is output when the error exceeds a certain value, adjusting the low resolution color signal).

14. As to claim 15, Quintana discloses a device wherein the comparator circuit is further configured to provide the dither control signal as a feedback signal to the accumulator module, and wherein the accumulator module is further configured to reduce the accumulated error based on the dither control signal (fig. 3, element 314; the accumulated value is adjusted based on a feed from the current output pixel).

15. As to claim 17, Quintana discloses a device wherein the adjustment circuit includes an adder circuit configured to add the accumulated error to the high resolution color signal, thereby generating an intermediate color signal (fig. 3, element 308).

16. As to claim 18, Quintana discloses a device wherein the conversion circuit includes a truncator circuit configured to reduce the intermediate color signal to a low resolution color signal (fig. 3, element 310; the color is reduced to zero if it does meet a threshold).

17. As to claim 20, Quintana discloses a graphics processing unit comprising:

a geometry pipeline unit configured to generate pixel data for an image (fig. 4, 5; image-forming and output pixel data mechanisms are disclosed);

and a scanout module configured to provide the pixel data to a display device (fig. 3, element 106; a pixel is output), wherein the scanout module includes a dithering unit, the dithering unit comprising:

an accumulator module configured to track an accumulated error across a plurality of pixels of the image (fig. 3; p. 2, section 0025; an "accumulated error" is a running total of differences between intensity values and actual output values; the current pixel is also included at fig. 3, element 312);

a conversion module configured to receive a high resolution color signal for a current pixel of the image and to generate a corresponding low resolution color signal (fig. 3, p. 2, section 0025; the example of a 186 color component value is given in a 0 or 255 binary system);

an adjustment module configured to modify the low resolution color signal from a first color to a second color for the current pixel in the event that the accumulated error exceeds a threshold (fig. 3, elements 310, 106; an "on" pixel is output when the error exceeds a certain value, otherwise the pixel is not turned on; the "current" color is changed from a value that would just be rounded to an error-adjusted value reading on a change from "first color" to "second color");

and an output module configured to output the low resolution color signal for the current pixel for display on a display device (fig. 3, element 106; p. 2, section 0025; a final pixel color value of 0 or 255 is selected for output on a printer, which reads on a display device; this final color value that appears on a piece of printed paper corresponds to white if 0 and cyan, magenta, yellow, or black if 255).

Claim Rejections - 35 USC § 103

18. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

19. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Quintana in view of Keithley (U.S. Patent Number 6,028,677).

20. As to claim 6, Quintana does not expressly disclose a method wherein the plurality of pixels corresponds to a scan line of a display device. Keithley, however, teaches an error diffusion method that does correspond to a number of pixels in a scan line (col. 5, lines 11-15). The motivation for doing error diffusion by scan line is to

minimize memory requirements for a dither operation (col. 2, lines 15-30). It would have been obvious to one skilled in the art to modify Quintana to perform error diffusion by scan line in order to minimize memory requirements as taught by Keithley.

21. As to claim 7, Keithley discloses a method further comprising the act of initializing a threshold value at a beginning of the scan line (col. 3, lines 29-57). While this does not precisely correspond to an "accumulated error", they are functionally equivalent. Changes in either one of the values simply make the result of a comparison less dependent on a previous scan line.

22. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Quintana in view of Keithley and further in view of Li (U.S. Patent 6,563,957).

23. As to claim 8, Keithley does not disclose an accumulated error initialized to a value that depends at least in part on a line number of the scan line, instead selecting values at random. Li, however, discloses changing an error diffusion filter based on an even or odd line number (col. 19, lines 26-34). Much like the Keithley reference, Li is not changing an actual "error accumulation value", but is teaching the advantages of changing qualities related to error diffusion by line. The motivation is to improve texture quality while also not increasing computational complexity (col. 19, lines 26-34). It would have been obvious to one skilled in the art to modify Quintana in view of Keithley to make changes in values related to error diffusion based on a line number in order to improve texture quality efficiently as taught by Li.

24. As to claim 9, Keithley discloses a method wherein the accumulated error is initialized to a value that is different for successive frames (col. 3, lines 29-57; because

each value is initialized randomly, a different value for successive frames is extremely likely to be inherent to the invention).

25. Claims 16 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Quintana.

26. As to claim 16, a device wherein the accumulator module includes some sort of storage configured to store the accumulated error is inherent to the invention of Quintana. The accumulated error must be saved somewhere to be used in later steps. Official notice has been taken of the fact that using a register as a storage is well-known in the art (see MPEP 2144.03). It would have been obvious to one skilled in the art to modify Quintana to use a register in order to efficiently store a value for later use.

27. As to claim 19, Quintana discloses a device wherein the truncator circuit is further configured to reduce the intermediate color signal by removing a number of least significant bits (fig. 3, p. 2, section 0025; changing 186 to a value of 0 or 255 inherently means that a number of least significant bits will become zeros) and to store the removed least significant bits as a new accumulated error (fig. 3, element 312; the "current error" or absolute difference would then become part of an accumulated error). Quintana does not expressly disclose a register. Official notice has been taken of the fact that using a register as storage is well-known in the art (see MPEP 2144.03). It would have been obvious to one skilled in the art to modify Quintana to use a register in order to efficiently store a value for later use.

Conclusion

28. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron M. Richer whose telephone number is (571) 272-7790. The examiner can normally be reached on weekdays from 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kee Tung can be reached on (571) 272-7794. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AMR
5/3/07

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